AMENDMENTS TO THE SPECIFICATION

All pages 1-46 of the application, in the Header, change the Docket No. as follows:

Dolinski et al.

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Docket No. ~~12063/11~~ <u>PUL01</u>

Page 1 of the application, specification paragraph [03] and [04], amend as follows:

[03] The mixing of two or more immiscible liquids to form an emulsion has proved difficult if not impossible in some circumstances. Conventional industrial mixers/emulsifiers have been proposed to provide an emulsion from the raw material. However, in due time, the emulsion often separates to the original phases. In a mixture of oil and water, for example, long periods of the storage causes the emulsion to separate into its original phases. ~~Because oil is heavier that water, the water phase rises to the top and the oil phase settles as the lower layer.~~ In addition, mechanical mixer/emulsifiers have the shortcoming of requiring the expenditure of a great deal <u>of</u> mechanical energy to combine the immiscible raw material into an emulsion. As will be discussed, this is due to <u>the</u> exertion of energy to the entire composition resulting [in] ineffective use of energy. Aside from the cost of producing the required energy, the energy exerted to the raw material can have adverse effects. For example, in a polymeric reaction <u>the</u> emulsifier's energy can cause undesirable side reactions.

[04] To prevent phase separation and to provide a more stable mixture of the immiscible starting material, [an] <u>a</u> surfactant (also known as an emulsifier) is often used. Surfactants usually consist of various oils and oil additives, for which the characteristic linear dimension can be represented by the length of the molecule. [A] [type] <u>Types</u> of conventional surfactants are polymers which can <u>be</u> subdivided to natural or synthetic. Synthetic polymer surfactants have a length of 40 to 50 ~~nonometers~~ <u>nanometers</u> while natural surfactants have a length of 50-60 ~~nonometers~~ <u>nanometers</u> . However, even with the addition of emulsifiers, phase separation is still possible. Further, the emulsifier itself may introduce undesirable

impurities in some applications. Accordingly, there is a need for a more efficient and effective mixing technology.

Page 3 of the application for paragraph 5 amend as follows after the Heading "Summary of the Invention":

[05] <u>A method and apparatus for providing a substantially homogeneous composition from partially immiscible liquids is disclosed wherein effective energy is applied as short pulses of a given frequency to the interface region of an emulsion. The method and apparatus of the invention show substantial savings and efficiency in comparison with conventional methods.</u> In one embodiment, the present invention is directed to a method for processing a substantially heterogeneous composition to a substantially homogeneous solution by providing a heterogeneous medium having [a] <u>an</u> interface region and applying energy to the interface region of the heterogeneous medium.

Page 4 and 5 of the Application for paragraph 16 amend as follows:

[16] Figure 1[,] schematically shows <u>the</u> interface region between [to] <u>two</u> immiscible components. The immiscible components of FIG. 1 can be liquid-vapor or liquid-liquid. <u>In Figure 1,</u> the [The] liquid-gas (vapor) interface or interface between two mutually immiscible liquids consists of a ~~simple or general successible~~ surfactant ~~layers~~ <u>layer</u>. This layer stabilizes the interface surface thereby stabilizing the self-organization of the disperse structure of the heterogeneous system. Generally, the surfactant molecules exhibit a branched out, multi-radical structure. ~~However, since~~ [their] <u>Their</u> force interaction results in the formation of at least a single monolayer oriented along the molecule perpendicular to the phase interface. In natural systems, for example the emulsion of natural milk, the structure of the surfactant layer at the inter-phase between the fat globule and the milk plasma (a water analog) consists in a sequence of three monolayers of different milk proteins that closely adjoin one another. This complex and branched structure of the surface of the fat globule of a milk emulsion makes it extremely elastic and strong, hence stable to deformation and fragmentation (*i.e.* emulsification and homogenization). This feature is also responsible for difficulties encountered in designing [a] homogenizing equipment.

Pages 5 and 6 of the application for paragraph 17 amend as follows:

[17] The presence of the surfactant layer is confirmed by the principle of minimum surface energy:

$$E = \sigma . S \qquad (1)$$

Where E is the surface energy, σ is the surface tension and S is the surface area of the particle. Thus, either S approaches minimum or σ, in order to bring about self-organization of the phase/inter-phase in the shape of a sphere (at *a priori* equal volumes) or the reduction of surface tension by means of various factors, in particular, [but] the addition of chemical surfactants, imposition of fields - thermal, electrical, magnetic, electromagnetic, etc. or introduction of chemical additives. This, the addition of a microscopic quantity of oil as a surfactant pure water-vapor surface where σ = 73-74 mN/m, releases the value of σ almost 1.8 fold to σ = 39-43 mN/m. Another example is natural milk, in which the surface tension at the time of interface between the shell of the natural fat globule and the plasma of the emulsion of natural milk is extremely small and, according to available publications σ = 1.12 ± 0.06 mJ/m^2. These values are commensurable with the interface tension at a gas/liquid metal ~~inter-f hase~~ interphase. The thickness of a surfactant monolayer that envelops, for example, the water/vapor phase interface is several nanometers (see thickness of the surfactant of FIG. 1). ~~Since the~~ PET is intended to bring about perturbation, deformation, decomposition and the subsequent restoration. The time scale of implementation of the PET principle can be estimated in several ways. First, the characteristic times of decomposition of the phase interface for hydrodynamic fragmentation of liquid or vapor/gas inclusions of a liquid system correspond to the period of natural oscillation frequency of the pertinent inclusion. Obviously, fragmentation is a resonance process and manifests itself [,] upon the natural frequency of the inclusions and the frequency of the applied perturbation. For example, the natural period of a 2 micron as bubble is 150 nanoseconds, whereas the natural frequency of a liquid particle of similar size is approximately 50 nanoseconds (that is, the fragmentation time corresponds to a sub-micro second or a nanosecond scale.

Page 10 of the application for paragraph 28 amend as follows:

[28] High-intensity shear stresses are attained at low linear dimensions in fluid discharge or flow devices such as in rotating or circular flows in small slots or narrow gaps, when fluid flows at high pressure through special valves, matrices or nozzles. This method of utilizing PET is most effective [fox] for high-viscosity non-Newtonian fluids.

Page 21 of the application for paragraph 58 amend as follows:

[58] ~~Equations (1.1)-(1.10)~~ The preceding equations comprise the general set of equations of dynamics [ox] of a single bubble. These equations must be supplemented by initial conditions, data on the variation in the thermophysical properties of the liquid (density, viscosity, surface tension, specific heat of vaporization), and also by the time dependence of the variation in the pressure above the liquid.

Page 21 of the application for paragraph 59 amend as follows:

[59] Results of calculations of the ~~babble~~ bubble model - According to the principles of the invention, the following [is] are the calculation results of a bubble dynamics based on the above-discussed model as shown in FIGS. 2-7. The vapor bubble arises within the liquid under the following conditions: a vapor bubble at temperature $t_{2,0}$= 120°C and defined by an initial radius R_0, which subsequently undergoes an oscillatory reduction in size (reduction in radius) and, in the end, collapses, becomes instantaneously a part of the ambient liquid (water) at temperature $t_{1,0}$ = 30 °C and at standard pressure.

Page 21-22 of the application for paragraph 60 amend as follows:

[60] FIGS. 2 to 7 show the vapor-water system in the course of the first oscillatory period. Referring to FIG. 2, the dynamics of the bubble radius and of the radial rate of oscillations of the interphase FIGS. 2 to 7 show the results of the variation in time of the parameters of (for R_0 = 10 μm) is shown. The behavior of the radius of the bubble is asymmetrical. That is, the rate of reduction in the radius is higher during the compression half period than the local growth of the bubble during the subsequent period. This means that the absolute rate of compression exceeds this

rate at expansion (See FIG. 2). The velocities may be as high as 700 m/sec. which is quite appreciable. The attendant of phase interface are highest when the bubble radius is at minimum size and may attain values of 10^{10} m/sec (See FIG. 3) *i.e.*, are equal to billion-fold the acceleration due to due to gravity. When phases change, their velocities change with attendant acceleration. The vapor temperature within the bubble is at maximum when the pulsating radius is at minimum (See FIG. 4). The high temperature is caused by the concentration of the kinetic energy of the interface on the bubble and may amount to more than 1500°C during the first half period. Under these conditions the instantaneous vapor pressure rises during 1-5 ~~nanosececonds~~ nanoseconds to approximately 12 thousand atmospheres (See FIG. 5). The specific kinetic energy of a collapsing bubble at the points in time where the radius is at minimum exhibits two peaks (See FIG. 6), attaining a limiting value in excess of 300 J/cm^3, whereas the specific density of kinetic energy of the compressed bubble (See FIG. 7) increases to 100-300 MW/mm^3.

Page 26 of the application for paragraph 66 amend as follows:

[66] where m is the mass ~~is the mass~~ of the molecule and v is its velocity. The energy of rotational motion for the elementary case of a diatomic molecule can be determined by:

(18)

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